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ABSTRACT

Hypothesizing that severely language delayed children lack sufficient understanding of causal structure to comprehend stories, a reading program concentrated on developing the causal reasoning of 10 children between the ages of 10 and 12 with a verbal intelligence quotient two to three years below average. Instructional activities in the eight-week program stressed (1) identifying story information categories and causal relationships in simple and more complex stories, (2) completing macro-cloze exercises, (3) creating story trees or graphs, and (4) initiating and responding to inferential questions about causal relationships in stories. Comparing the instructional group's pretest and posttest causal reasoning and recall scores with those of six students of similar age and aptitude indicated that the instructional group did make progress but that the progress varied across tasks and across children. The results showed no significant improvement in student recall. The data demonstrated the importance of matching the instruction to children's readiness level and indicated that global effects of new instruction are unlikely. It also indicated that causal relationships among elements within and between story episodes are important aspects of reading skill. (Extensive tables are appended.) (MM)

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Causal Structure Instruction and Story Comprehension for Mildly Handicapped Children

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One aspect of reading comprehension is the ability to understand the logical connections among different pieces of information in a text. For some children progress in the acquisition of reading and other verbal skills proceeds at a rate much slower than normal whereas acquisition of non-verbal skills proceeds at an average rate. In the state of California, children with this type of profile are classified as severely language delayed. An important issue for such "language delayed" children concerns the identification of instructional treatments that optimize the rate of acquisition of reading skills. The present work involved the explicit teaching of the logical relationships among different kinds of information that occur in story texts. In particular, the instruction focused on causal relationships between goals and attempts to satisfy those goals.

Previous theoretical and empirical analyses of stories suggest that an important unit of stories is the problem solving sequence that is embedded in the story. Such a sequence involves the formulation of a goal in response to some set of conditions that are described in the beginning or initiating event of the story. Goal formulation causes some attempt to meet the goal and the actions that comprise the attempt cause some consequence. In the majority of

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simple stories, goal accomplishment is the consequence. This relatively basic causal chain in an episode is depicted in Figure 1. This figure also illustrates another type of simple episode, one in which the attempt is unsuccessful and the goal remains unmet at the conclusion of the story. The implications for the causal structure are depicted in Figure 1.

As more episodes are added to a story, the types of relationships between episodes are also important. In some stories, the goal of one episode can be met only by the creation of a series of subgoals and episodes that are subordinate to the main goal. Such embedding leads to the type of story shown in Figure 2. In other cases of multiple episode stories, there is more of a temporal than causal relationship: the goal of each episode is dealt with prior to the initiation of subsequent episodes and goals. We have referred to this type of story as goal sequential. These examples illustrate some of the variations in causal structure that might occur even in "sanitized" stories.

The hypothesis of this research was that one problem for language delayed children is that they do not have a sufficient understanding of causal structure to comprehend stories occurring in their reading lessons. By focusing on causal structure, we expected comprehension to improve over pre-instruction levels. Two measures of comprehension were used: responses to "Why?" questions and free recall of the stories. Why question responses are a "near" test of the effects of the causal structure instruction since they tap exactly the sorts of relationships that were directly taught. Recall can be considered a "far" test of the effects of instruction since skills in addition to understanding causal structure govern the amount of information in story recalls, for example, general memory and language production skills.

The instructional activities were of four general types:

1. Identification of story information categories and the causal relationships among them in simple and more complex stories;

2. Completion of "macro-cloze" (Whaley, 1981) exercises for story information categories and for story episodes;

3. Creation of "story trees" (Rubin, 1980);

4. Creation and response to inferential questions about the underlying causal relations in different stories.

Instruction occurred over a period of eight weeks. Sessions were 20 to 30 minutes in length each day and were part of the regular reading curriculum. Over the eight weeks, the nature of the focal instructional activities progressed from relatively isolated activities to integration of the various activities. During the first week, the children practiced reading stories aloud, identifying words, sentences and paragraphs and locating particular words and sentences in stories that they had read. This initial phase was designed to acclimate the children to thinking of stories as consisting of different parts. These activities were also part of their regular reading curriculum and thus served as a transition to the special instruction.

During weeks two and three, children were taught how to identify different causal relations in sentences. This aspect of the causal relations instruction was designed to get the children to look for relations in sentences as a precursor to identifying relationships between parts of stories. For example, given the sentence John got very sick when he ate too many apples., the children would read the sentence and then the instructor asked a series of questions designed to get the children to identify antecedent and consequent events and the relationship between them. The

children were not taught any new terminology, although several children had previously finished workbooks on means-end analyses and spontaneously used these terms during instruction.

Concurrent with the single sentence causality instruction, children were taught to distinguish between different parts of stories. They were taught terms such as "Setting", "Beginning", "Goal", "Attempt", "Outcome" and "Ending." Note that the term "Try" was used instead of Attempt with one child who could not pronounce the word attempt. The children had very little difficulty learning the meanings of the terms and the function of the information categories. Nor did they experience difficulty when they had to use the terms to label different parts of simple, one-episode stories that had been visually parsed into story categories. This component of the instruction was designed to acquaint the children with the types of information contained in stories and was by no means an exhaustive attempt to teach the children a "story grammar".

During the fourth, fifth, and sixth weeks of instruction, the children were taught to apply causal reasoning to information within an episode, i.e., between story categories. Starting with simple, one-episode stories whose content was familiar to the children, the instructor asked questions that required the children to focus on precursor, consequent and relational information among the categories in an episode. Over the three week period, these activities were extended to more complex, multi-episode stories. Throughout the instruction, it was emphasized that looking for these relations during reading would improve story understanding and make reading more interesting.

Concurrent with category causal relations instruction, children began

creating "story trees". This activity teaches comprehension through construction or production activities and is a technique that was first introduced by Andee Rubin (1980). Constructing story tree graphs provides children with the opportunity to learn and experiment with the causal relations among story categories. During the instruction, the children would make up different episodes about various story characters, given common beginning information. Children were asked to generate different beginnings for stories, different goals, different actions the characters could take, and different consequences. Each of these was written on different index cards. Children would then be asked to generate different types of stories by being asked to pick one of their goals, attempts, and consequences to make up a complete story. The instructions varied so that sometimes children were asked to pick an attempt that would not work, other times to pick one that would cause goal attainment. In this way, the children worked with their own self generated information to construct stories that manifested different sorts of causal relationships between story categories.

The story trees were also used to perform "macro-cloze" exercises: The instructor would remove a card from the story tree and ask the children to make up or remember appropriate information that would fill in the gap in the story. As the children became more skilled at this excercise, the instructor would remove multiple cards, up to removing information from an entire episode.

During the final two weeks of instruction, the children constructed increasingly complex story trees and performed increasingly complex macro-cloze exercises. In addition, the children began to generate their own causal questions for the instructor and other children to answer. Thus,

during the last two weeks of instruction, the children were given activities that were designed to get them to internalize the questioning procedures as a means of identifying the causal relations between story events.

The children who participated in the instruction were 10 children in a self-contained elementary school Special Education classroom for "language delayed" children. The children ranged in age from 10 years to 12 1/2 years, with a mean age of 12 years, 5 months. All the children had average nonverbal IQ scores but verbal IQ scores of 2 to 3 years below average. Reading levels for these children ranged from second half of second grade (1 child) to first half of fourth grade (5 children), determined by the level at which each child was working in the MacMillan Reading Curriculum series. Two children were at the third grade, first half and two were at third grade, second half levels. A second group of six children participated in the pre and post instruction assessment, although they did not receive any of the experimental instructional activities. These children were in regular education classrooms in the same elementary school and were receiving resource room services. Reading level for this group was fourth grade, second half and mean age was 11 years. Nonverbal IQ scores of these children were equivalent to those of the instructional group children. The resource room group serves as a comparison group rather than a control group in the usual sense of the word: the performance of this group of "mainstreamed" children provides a comparative index of performance by a group that while somewhat language delayed are able to particpate in less-restrictive environments than those of the instructional group children. Thus, comparisons with the performance of these children provides an indication of the amount of progress made by the instructional group children, progress towards participation in a regular education

classroom.

Pre and post test assessments consisted of the battery of tasks shown in Table 1 of your handout. Specific materials were counterbalanced so that different content material was presented to an individual at the two testing times. All of the tasks were drawn from extant empirical work conducted with elementary school children of normal or above average reading ability (see Glenn, 1978; Goldman, in press; Goldman & Varnhagen, 1983; Mandler, 1978; Varnhgen, Hartwig & Goldman, 1982). The materials used contain vocabulary at the second and third grade level. The assessment tasks included both simple and complex stories and texts that do not have information that is causally related, the Action sequences. Recall and question answering after both listening and reading comprehension were assessed. In addition, scrambled stories were presented and the children were asked to reorganize and recall these stories. Story completion and metacomprehension data (Myers & Paris, 1978) were also collected. As yet, the story completion and metacomprehension data have not been analyzed and therefore will not be discussed here.

In general, the differences between pre and post test performance indicated that the instructional group did make progress over the eight weeks. However, the degree of progress varied across tasks and across children. Such variation is not surprising since the type of training provided would be expected to have differential effects on different tasks and dependent measures. Furthermore, initial levels of performance on the different tasks provide differential "room for improvement." Consider first the results of the Why questioning on the complex causal three episode stories. The training specifically focused on the aspect of stories directly assessed by this task. Therefore, we would expect the most change for

responses to this type of task. The data are shown in Table 2 and represent responses to three Why goal? and three Why action? questions. For the Goal embedded stories, the responses should reflect Across Episode to a greater degree than Within Episode causal relationships. This is the case because the goal of the first episode causes the goal of the second episode, and that of the second, the goal of the third. Similarly actions in the third episode meet the third episode goal as well as the goal of the second episode. The responses of the Comparison group reflect this tendency: 61% are across episode and 38% are within episode connections. For the instructional group, there are two major effects of training: there is a decrease in the number of no responses and an increase in the number of across episode connections. In the Goal sequential stories, the dominant responses should be Within Episode causes. The training again produced a reduction in the number of no responses. There was no increase in the number of within episode responses, however about 60% of the responses were of this type prior to training.

As mentioned earlier, recall performance is actually a "far" test of the effect of training because causal relationship understanding is only one the skills necessary to recall stories. Furthermore, the training was predicted to lead to differential improvement on the different tasks. This was observed. In addition, the recall results replicated the Why question results, showing an interaction of pre-training performance levels and degree of improvement. The evidence for these claims is shown in Tables 3 and 4. First, consider the results for the Action Sequence, where the training would be expected to have no effect. As can be seen in Table 3, recall levels are low for both the comparison and instructional groups and show no effect of training. Similarly, the simple causal stories show some improvement but the

effects are localized largely in the range of performance rather than in mean recall performance. Note however, that the reading task showed more improvement than the listening tasks. The Scrambled stories showed some improvement in the range but little improvement in the mean level of recall. For this task, understanding referential coherence may be more important than understanding causal coherence.

The Complex causal stories generally showed more improvement than the simple causal stories, especially after reading. The improvement is manifested in both mean performance and in the range of performance. The range data are important because it is possible for the training to have major effects on a few children and no effect on the rest. We therefore examined individual change scores for the subjects in the instructional group. These data are given in Table 4 for the Complex causal stories. Individual subject data are organized in terms of increasing reading level. In general the data indicate that the training had the greatest effect on the seven students who were reading at or above second half of third grade. Effects on the three students below this reading level were quite variable. The effect of the training on the complex causal stories was to increase recall performance to a level roughly equivalent to the level of the comparison group.

Several conclusions and cautions are suggested by the results of this instructional intervention study, although we make no claims to be the discoverers of them. The data demonstrate the importance of matching the instruction to the developmental or "readiness" level of the child. Futhermore, global effects of "new" instruction are unlikely and very specific predictions about tasks that training should affect must be made in order to adequately evaluate the "success" of any new method. We are encouraged by the

results of our instruction however. The training did improve the performance of the majority of these severely language delayed children to levels more comparable to their mainstreamed peers. Finally, it does seem to be the case that understanding the causal relationships among elements within and between episodes in stories is an important aspect of reading skill, especially as children attempt to advance from basic "word calling" to being able to meaningfully integrate the called words.

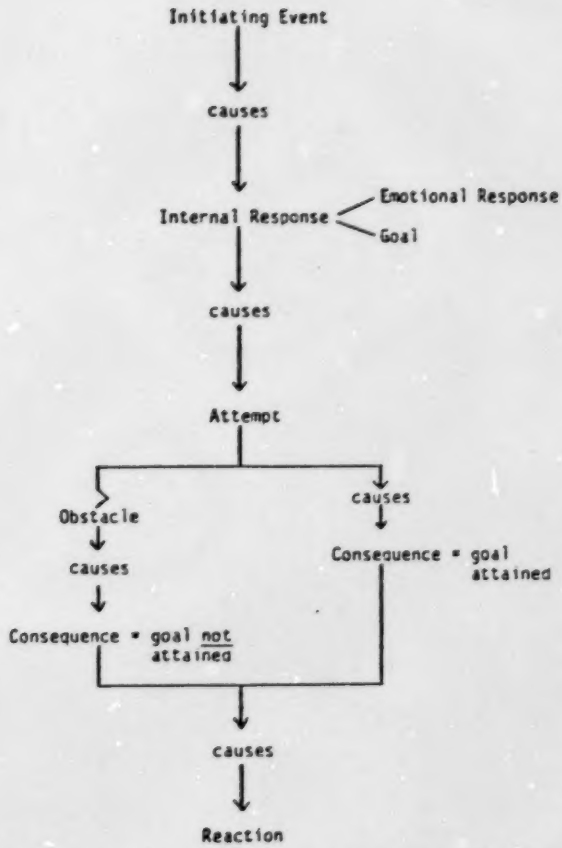

FIG. 1.—Schematic of causal chain in episodes with and without obstacles to goal attainment

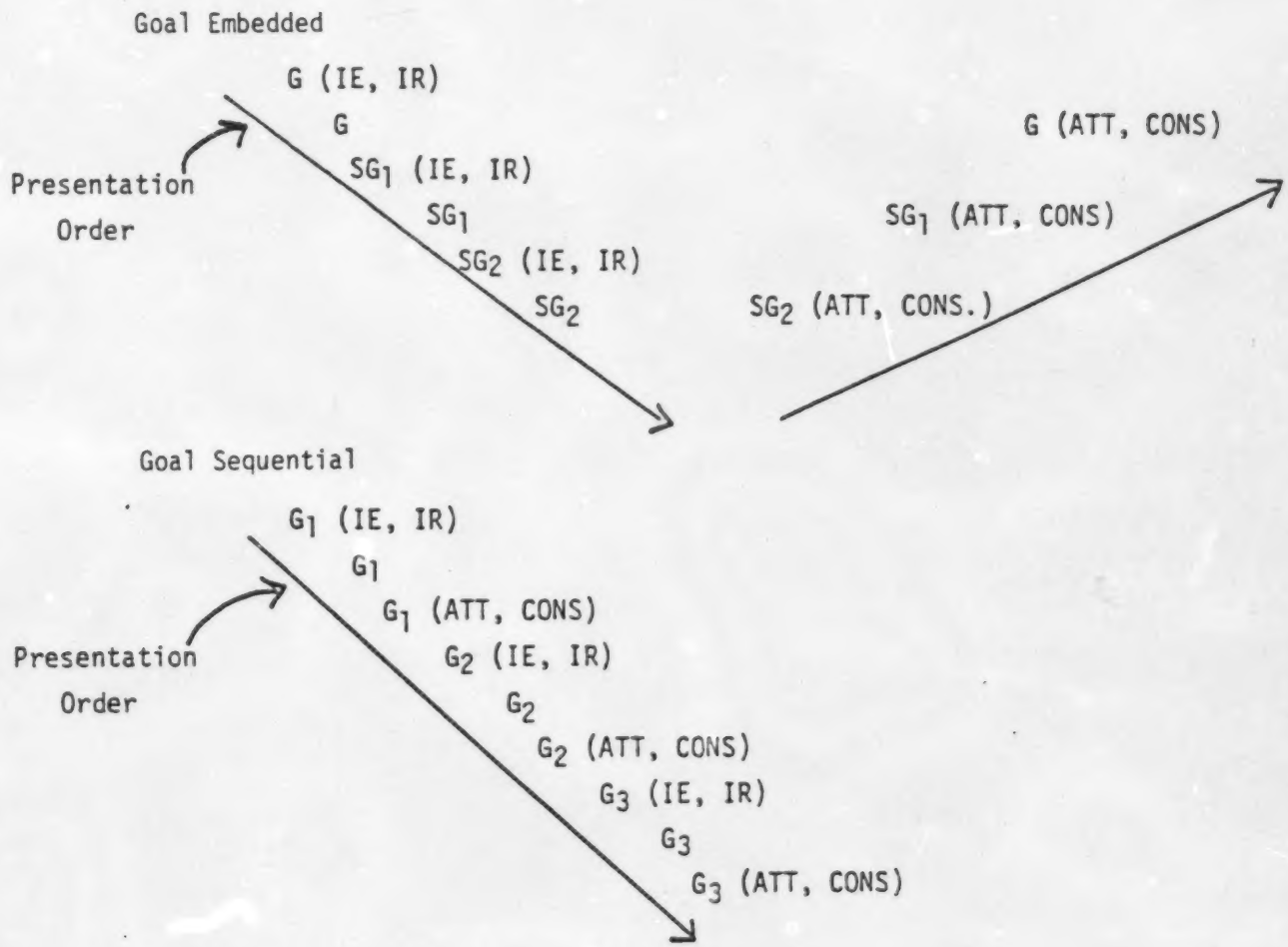
Goal Embedded
G (IE, IR)
G
SG1 (IE, IR)
SG1
SG2 (IE, IR)
SG2
Presentation
Order
G (ATT, CONS)
SG1 (ATT, CONS)
SG2 (ATT, CONS.)
Goal Sequential
G1 (IE, IR)
G1
G1 (ATT, CONS)
G2 (IE, IR)
G2
G2 (ATT, CONS)
G3 (IE, IR)
G3
G3 (ATT, CONS)
Presentation
Order

Figure 2

Table 1

Pretest and Postest Assessment Battery

Type of Task/Text	Description	Dependent Measures
Action Sequence Text	Listen to temporally organized events (Hahn, 1983)	Recall; Responses to "What" questions
Short simple causal one-episode stories	Listen to one, read one no obstacle story (Goldman & Varnhagen, 1983)	Recall; Responses to "What" questions; Responses to "Why" questions
Short complex causal one-episode stories	Listen to one, read one obstacle story (Goldman & Varnhagen, 1983)	Recall; Responses to "What" questions; Responses to "Why" questions
Long simple causal one-episode stories	Listen to one-episode story twice the length of the short simple stories (Glenn, 1978)	Recall; Responses to "What" questions; Responses to "Why" questions
Scrambled simple causal stories	Listen to two-episode "interleaved" stories (Mandler, 1978)	Recall; Responses to "What" questions
Long complex causal three episode stories	Listen to three-episode goal sequential and to three-episode goal embedded stories (Goldman, in press)	Recall; Responses to "What" questions; Responses to "Why" questions
Story completion	Generate two stories from beginning information (Glenn & Stein, 1981)	Structure of story
Metacomprehension	Answer questions about what a story, how to remember stories (Myers & Paris, 1978)	Concept of a story; functions of a story; Knowledge of own memory functioning

Table 2

Changes in Responses to Why questions for

the Goal Embedded and Goal Sequential Stories*

	Within Episode Cause	Across Episode Cause	No Response
Goal Embedded			
Pretest	.43	.27	.30
Postest	.48	.43	.09
Comparison Group	.38	.61	.02
Goal Sequential			
Pretest	.62	.15	.23
Postest	.67	.27	.07
Comparison Group	.79	.20	.02

*Data are the proportion of responses in each category. For the Pretest and Postest, the total number of responses is 60 (6 responses from each of ten children). For the comparison group, the total number of responses is 66 (6 pre and 6 postest responses from 5 children plus 6 pretest responses from one child, who moved prior tc the postest assessment).

Table 3

Mean Recall Performance on Pre and Postests*

Task		Pre Test Comparison	Pre Test Instructional	Post Test Comparison	Post Test Instructional
Action Sequence		.13	.10 (0 - .3)	.15	.12 (0 - .3)
Simple Causal					
Short, one episode	List.	.49	.49 (.08 - .83)	.57	.58 (.17 - .75)
	Rdg.	.63	.53 (.08 - .83)	.68	.65 (.33 - .83)
Long, one episode	List.	.44	.37 (.05 - .52)	.50	.47 (.24 - .76)
Scrambled, two episodes	List.	.25	.25 (0 - .52)	.35	.30 (.14 - .62)
Complex Causal					
Short, one episode	List.	.60	.58 (.25 - .83)	.63	.63 (.17 - .83)
	Rdg.	.65	.58 (.17 - .83)	.67	.71 (.25 - .92)
Goal embedded (3 eps.)	List.	.43	.37 (.07 - .67)	.54	.45 (.15 - .70)
Goal sequential (3 eps.)	List.	.53	.31 (0 - .56)	.50	.48 (.26 - .74)

*Range data are shown in parentheses.

Table 4

Change Scores for Complex Causal Tasks

for Instructional Subjects

Reading Level	Subject Number	Short, one episode*	Task Goal embedded	Goal sequential
	Mean Change	+.13	+.08	+.17
2,2	6	+.09	-.07	+.22
3,1	5	-.08	+.03	+.03
3,1	9	+.25	+.15	-.11
3,2	4	-.08	+.40	+.48
3,2	10	+.08	+.34	+.52
4,1	1	+.08	+.03	+.22
4,1	2	+.16	+.07	+.04
4,1	3	+.17	-.04	-.04
4,1	7	+.23	0.0	+.07
4,1	8	+.34	-.07	+.22
4,2	Comparison group	+.02	+.11	-.03

*Reading Task

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